THE NATURE OF NOTEBOOKS

How Enlightenment Schoolchildren Transformed the *Tabula Rasa*

ABSTRACT

John Locke's comparison of the mind to a blank piece of paper, the *tabula rasa*, was arguably one of the most recognisable metaphors of the British Enlightenment. Though scholars embrace its impact on the arts, humanities, natural sciences and social sciences, they seldom consider why the metaphor was so successful. Concentrating on the notebooks made and used by the schoolchildren of Enlightenment Scotland, this essay contends that the answer lies in the material and visual conditions that gave rise to the metaphor's usage. By the time students had finished school, they had learned to conceptualise the pages, the script and the figures of their notebooks as indispensable learning tools that could be manipulated by scores of adaptable folding, writing and drawing techniques. I reveal that historicising the epistemology and manipulability of student manuscript culture makes it possible to see that the success of Locke's metaphor was founded on its appeal to everyday notekeeping activities performed by schoolchildren.

BEYOND THE *TABULA RASA*

The *tabula rasa* is perhaps the most well-known metaphor used to describe the minds of young learners during the eighteenth-century. It inferred the possibility of achieving a state of filledness, one in which the writtenness of script served both as a form of order and a bearer of meaning. Consequently, in addition to comparing two objects - the mind and a piece of paper – the *tabula rasa* also compared two modes of interface – thinking and writing. Thinking transformed an empty mind into

a filled mind. Writing transformed a blank page into a written page.[1]

For the past two centuries historians of the arts, humanities, natural sciences and social sciences have conceptualised the *tabula rasa* primarily as an object, with comparisons being drawn between a sheet of paper and other object-based metaphors that adults used to compare the mind to a cabinet, theatre, room, or a house.[2] But, what if we moved the focus from objects to modes? That is to say, what if we flipped the metaphor so that writing as thinking served as the starting point for understanding the mind as a piece of paper? And what if, instead of focusing solely on prescriptive treatises written by adults, we went even further and applied the question to handwritten artefacts actually made and used by schoolchildren?

During the Enlightenment schoolchildren learned a rich array of techniques that helped them to transform blank sheets of paper into the manuscript pages of a notebook. Whereas historians have given some attention to how textbook authors praised penmanship,[3] we know very little about how such skills were internalised or applied by school students, particularly by learners whose future professional or domestic duties would require them to move well beyond singular sheets of paper

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[1] Brad Pasanek, *Metaphors of Mind: An Eighteenth-Century Dictionary* (Baltimore: Johns Hopkins University Press, 2015), 227-248.

[2] Pasanek (2015), 205-226.

[3] Aileen Douglas, *Work in Hand: Script, Print, and Writing, 1690-1840* (Oxford: Oxford University Press, 2017). Tamara Plakins Thornton, *Handwriting in America: A Cultural History* (New Haven: Yale University Press, 1998).

into a world of voluminous, self-organised codices used to order everything from accounts to recipes.

How were the techniques required to make such a sophisticated scribal artefact internalised? This question is particularly relevant to notebooks because of the special role they played in codifying and organising knowledge systems. Notebooks now receive attention as the informatic precursors to the multimedia forms of interface offered by today's digital culture, leading a number of historians to conceptualise them as paper technologies, or, in the words of Anthony Grafton, magnificent 'machines' that operated according to 'multiple impure information regimes'.[4]

Far from being a mindless act of replication, the acts of moulding, writing and drawing notebook pages were increasingly conceptualised from the seventeenth century forward as a mind-transforming performance. In many respects, the nature of notebooks, like the nature of printed books, was dynamic in that they were objects that instantiated a process of knowledge in the making.[5] The rise of

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[4] Anke Te Heesen, 'The Notebook: A Paper-Technology', in Bruno Latour and Peter Weibel (Eds.), *Making Things Public. Atmospheres of Democracy* (Cambridge: MIT Press, 2005), 582-589. Anthony Grafton, 'The Republic of Letters in the American Colonies: Francis Daniel Pastorius Makes a Notebook', *American Historical Review*, **117** (2012), 1-39; quotations from pages 23 and 39.

[5] Here I am referring specifically to the epistemological variations of print culture revealed and historicised by Adrian Johns in *The Nature of the Book: Print and Knowledge in the Making* (Chicago: University of Chicago Press, 1998). For

notebook usage during the early modern period amongst the middling classes took place at a time when the classical and medieval belief that most things could be held in the memory was giving way to the modern notion that the human mind could no longer hold all of the knowledge being produced by print culture. As shown by Richard Yeo, in addition to being an aid to memory, the notebook became a paper technology that extended the mind.[6]

Focusing on the Scottish Enlightenment, this essay contends that the design and construction of student notebooks can help us better understand the material and visual preconditions that sustained the developmental resonance of the *tabula rasa* metaphor during the Enlightenment. When approached via its eighteenth-century usage, the Latin term '*tabula*' invites a dynamic and adaptable conceptualisation of the *tabula rasa* as an interactive learning tool. During the early modern period, this word (and its vernacular form of 'table') was used to describe any visualisation made on a square or rectangular surface (a sheet of paper in this

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epistemological foundations of notekeeping, see Hans-Jörg Rheinberger, 'Scrips and Scribbles', *MLN*, 118, (2003), 622-636, and Christoff Hoffmann, 'Processes on Paper: Writing Procedures as Non-Material Research Devices', *Science in Context*, **26** (2013), 279-303.

[6] Richard Yeo, *Notebooks, English Virtuosi, and Early Modern Science* (Chicago: University of Chicago Press, 2014). For the longstanding relationship between memory and graphic culture, see Douwe Draaisma, *Metaphors of Memory: A History of Ideas about the Mind* (Cambridge: Cambridge University Press, 2000).

case).[7] In Britain schoolbooks regularly used this wider notion of a table until the early nineteenth century. For instance, *The Royal Standard Dictionary*, a book written by the Edinburgh academy master William Perry and marketed to Scottish schoolchildren, defined 'table' as 'any flat surface' and 'tabular' as an object 'formed in squares or plates'.[8] This means that, at the most basic level, every page was a '*tabula'*.

Concentrating on notebooks made by students who attended the schools and academies of eighteenth-century Scotland, I suggest that, in order to organise and codify a codex, young notekeepers needed to learn three core paper-based techniques of interface, each of which consisted of an integrated set of skills that had to be learned through iteration. First, there was the technique of moulding a sheet into a page, a *tabula folia*, through acts of folding, cutting, gathering, flattening and binding sheets into pages. Second, there was the technique of writing a page, a *tabula verba*, through acts of composing, cyphering and compositing the page into an accessible layout. Third, there was the technique of drawing a page, a *tabula figura*, through acts of dialling, diagramming, stylising and positioning figures.

My conceptualisation of a notebook bears many similarities to the ways in which scholars are increasingly characterising objects and artefacts in relation to their material and visual affordances. In his work on early modern visual culture, for instance, the art historian Michael Baxandall argued that pictures, broadly

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[7] Stephen Ferguson, 'Systems and Schema, Tabulae of the Fifteenth to Eighteenth Centuries', *The Princeton University Library Chronicle* 69 (1987), 9-30.

[8] William Perry, *The Royal Standard Dictionary* (Edinburgh: Willison, 1775), 373.

construed, are best understood as 'purposeful artefacts', as 'material and visible deposits left behind by earlier people's activity.'[9] Following Baxandall's approach to paintings and their painters, the following sections reveal that historians can catch a glimpse of notekeepers' patterns of intention by excavating the techniques they used to make the pages of their notebooks.

Before we delve into how Scottish students acquired purposeful notekeeping techniques, it is necessary to briefly say a few words about how notebooks fitted into Scotland's educational system during the long eighteenth century. In most cases, Scottish students started to keep school notebooks after they progressed from a burgh or parish school to an academy, grammar school or private tutor in their early teenage years.[10] This does not mean that they did not keep other kinds of notebooks like commonplace books, diaries or sketchbooks. It simply means that school notebooks inhabited a specific place in the Scottish educational system.[11]

Though Scottish students kept school notebooks during the entire eighteenth century, today's extant specimens were made from the mid-century onward; an

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[9] Michael Baxandall, *Patterns of Intention: On the Historical Explanation of Pictures* (New Haven: Yale University Press, 1985). See especially page 13.

[10] The contemporary term used to describe students of this age was 'youth'. See *OED*.

[11] For further information on the other kinds of notebooks made by Scottish children (a number of which will be cited later in this essay), see Matthew Daniel Eddy, 'The Child Writer: Graphic Literacy and the Scottish Educational System, 1700–1820', *History of Education*, **45** (2016), 695-718.

occurrence that was no doubt linked to the changes in primary education that were made in response to the 1745 Jacobite rebellion and the onset of the new educational psychology promoted in the writings of John Locke.[12] Of the notebooks that have been preserved by the National Library of Scotland and other institutions, a notable number were made by students attending the Edinburgh High School and the Perth Academy – arguably the two most influential schools of the time.[13] Others were made by tutees who studied with private instructors giving lessons in small groups in cities such as Edinburgh, Glasgow, Aberdeen and St Andrews.[14]

Scottish school notebooks often were manuscript textbooks that collated what students had copied or learned first-hand.[15] Keeping this kind of notebook required

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[12] For Locke's impact on Scottish pedagogy, see Matthew Daniel Eddy, 'The Cognitive Unity of Calvinist Pedagogy in Enlightenment Scotland', in Ábrahám Kovács (Ed.), *Reformed Churches Working Unity in Diversity* (Budapest: L'Harmattan, 2016), 46-60.

[13] William Steven, *History of the High School of Edinburgh* (Edinburgh: Maclachlan and Stewart, 1849). William Morrison (Ed.), *Memorabilia of the City of Perth* (Perth: Morison, 1806).

[14] Most of the notebooks I use are housed in the special collections of the National Library of Scotland (hereafter NLS), Edinburgh City Archive (hereafter ECA), and Edinburgh University Library (hereafter EUL).

[15] Early modern manuscript textbooks are discussed throughout Thomas Knoles, Rick Kennedy and Lucia Zaucha Knoles (Eds.), *Student Notebooks at Colonial Harvard: Manuscripts and Educational Practice, 1650–1740* (Worcester, MA: American Antiquarian Society, 2003).

them to learn a number of graphic techniques that were directly applicable to the scribal demands they would face as literate adults operating in domestic, commercial, military or academic settings. Once they mastered the techniques required to perform school notekeeping, they were more ready to attend university lectures, become adult notekeepers or even participate in the wider European Republic of Letters.

Whereas historians sometimes conceptualise the manuscript textbook tradition as a form of rote learning, it was common for educators in Scotland, and in the Atlantic world more generally, to treat all forms of writing, including copying and composing, as routines that actively transformed the minds of children.[16] Students made notebooks with a view to learning the facts, principles and rules of the subjects that they were studying. Notebooks were also memory devices that helped students learn and access information on paper. In this sense they served a similar developmental role as printed textbooks in that they inculcated knowledge and served as material forms of remembering.

The most common subjects recorded in school notebooks were algebra, geometry, trigonometry, 'spherics', natural philosophy, geography, Greek, Latin, surveying, gauging and levelling. But the purpose of keeping a notebook was not solely to record facts.[17] School notebooks were multipurpose artefacts with uses

[16] William Huntting Howell, *Against Self-Reliance: The Arts of Dependence in the Early United States* (Philadelphia: University of Pennsylvania Press, 2015).

[17] The printed textbooks used to teach these topics are discussed in Alexander Law, *Education in Edinburgh in the Eighteenth Century* (Edinburgh: University of

that extended outside the immediate learning environment surrounding a student notekeeper. They demonstrated what a student had learned to fee-paying parents and they helped erstwhile students remember what they had learned when they became adults. From the perspective of teachers and tutors, school notebooks implicitly served as advertisements to what kind of instruction was on offer, a situation that undoubtedly led educators to seek out teaching methods that favoured the production of an attractive notebook. But perhaps the most important purpose of school notebooks was the fact that they were the main way that children learned the core writing, drawing and editing techniques required to set knowledge in motion on and through paper.

MOULDING TECHNIQUES

At first glance, the adaptability of a notebook page as a jointly material and visual object might not seem that obvious to the twenty-first century observer. This is mainly because the digital texts that we use today inhabit a different kind of materiality than that which existed during the Enlightenment – a flat materiality that makes it difficult to see that paper can be an epistemic object, that is, a dynamic

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Edinburgh, 1960) and Duncan Kippen Wilson, *The History of Mathematical Teaching in Scotland to the End of the Eighteenth Century* (London: University of London Press, 1935).

object that helps create knowledge.[18] This factor obscures the 'paperness' of predigital notebook pages and the fact that they were temporal objects that were oftentimes assembled from different kinds of paper over a period of time. Add to this the fact that today's extant school notebooks housed in special collections usually are packaged as leather bound volumes, giving the impression that the content and order of their pages was fixed at the time of composition and subsequent usage.

But for many school notebooks nothing could be further from the truth. The notebooks created by Scottish schoolchildren oftentimes did not begin as notebooks at all. They began as blank sheets of paper that could be ordered and reordered through folding, bending, creasing, gluing, piercing (with pins), gathering, stacking, shuffling, turning, ripping, scratching (a mode of erasure), sewing and binding, all according to the child notekeeper's needs as a learner. Though forgotten today, these practices were called 'moulding' techniques during the early modern period and they formed the manual and material bedrock of the *tabula rasa* metaphor, especially as it was formulated by John Locke in his widely read *Some Thoughts*

[18] The epistemological possibilities of paper tools are foregrounded in Michael Friedman and Wolfgang Schäffner, 'On Folding: Introduction of a New Field of Interdisciplinary Research', in Friedmann and Schäffner (Eds.), *On Folding: Towards a New Field of Interdisciplinary Research* (Bielefeld: Transcript Verlag, 2016), 7-30; Eric Livingston, *Ethnographies of Reason* (London: Routledge, 2008), 89-107. For early modern paper objects, see Anke te Heesen, *The Newspaper Clipping: A Modern Paper Object* (Manchester: Manchester University Press, 2014), 15-31.

Concerning Education. In the conclusion he famously intimated that the mind was a piece of 'white paper, or wax, to be moulded and fashioned as one pleases.'[19]

In the rest of this section I address core paper moulding techniques that schoolchildren learned whilst making a notebook. Since much work remains to be done on children's manuscript culture in general, it is more of a prolegomenon. Rather than being fixed, each page was a *tabula folia*, a quadriform, flexible learning device through which students internalised how to use moulding techniques to fashion a scribal container; an information management artefact that preserved what they learned in the classroom and which served as a form of user training for the many kinds of paper documents they would design or encounter as adults.[20]

To make a blank page, students first had to find and select sheets of paper. Though paper was a ubiquitous medium of communication during the Enlightenment, its many graphic affordances are strikingly absent from the cultural history of predigital Scotland, and of Europe more broadly. Scotland had a healthy paper industry and near the end of the century Edinburgh became a publishing powerhouse.[21] When it came to educational literature, Scotland's publishers either

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[19] John Locke, *Some Thoughts Concerning Education, Twelfth Edition* (Edinburgh: Brown, 1752), 324.

[20] For the historical importance of paper as a form of information management, see Lisa Gitelman, *Paper Knowledge: Toward a Media History of Documents* (Durham: Duke University Press, 2014).

[21] For Scottish paper and publications industries, see, respectively: Robert Waterston, 'Further Notes on Early Paper Making Near Edinburgh' *Book of the Old*

printed or imported works written by fashionable British pedagogues who stressed the utility of paper devices such as 'picture-books', geographical puzzles, and flashcards that contained the alphabet or 'the names and pictures' of noteworthy personalities. But, despite its importance, we are only just beginning to learn about the cultural life of paper in Scotland. [22]

Students kept notebooks for many subjects taught in Scottish schools. Based on the similarity of subjects and layouts that appear in notebooks preserved from schools and academies, students most likely copied their notes from exemplar posters, a tradition that was used by Scottish writing masters as well.[23] They cyphered on loose sheets, or even slates; a practice that was summed up in 1748 in James Todd's *The School-Boy and Young Gentleman's Assistant*: 'I say he [a student] should have one [geometry book] by him while he Works on his Slate, or his paper,

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Edinburgh Club, **27** (1949), 40-59; Richard B. Sher, *The Enlightenment and the Book: Scottish Authors and Their Publishers in Eighteenth-Century Britain, Ireland, and America* (Chicago: University of Chicago Press, 2008).

[22] Paper devices were often mentioned by pedagogical authors influenced by John Locke's writings. A prominent Scottish voice on this topic was Henry Home (Lord Kames), *Loose Hints upon Education* (Edinburgh: 1781), 61-64, 234-35. For the cultural importance of paper in Scotland at this time, see Claire Friend, *The Social Life of Paper in Edinburgh 1750-1820* (University of Edinburgh: Unpublished PhD Thesis, forthcoming).

[23] Edmund Butterworth, *Universal Penman, or, The Beauties of Writing Delineated* (Edinburgh: 1785).

as he has his Grammar by him, for culturing in parsing, &c. of Language.'[24] Once committed to paper, these acts of copying and cyphering produced what Scots sometimes called 'scroll books', that is, rough notes or draft copies that were then recopied as a neater set of notes at a later date. From the seventeenth to the nineteenth century, the term 'scroll book', also spelled 'scrow buik', was used in Scots English to refer to 'a school rough notebook'.[25] The writing of scroll books occurred at every level of literate society and, as can be seen in those produced by the clerks recording the minutes of Edinburgh City Council, they sometimes existed within a vast system of scribal culture that historians have only just begun to understand.[26]

The majority of Scotland's extant school notebooks are recopied manuscripts based on a student's scroll books. The writing and drawing techniques practised on the pages of scroll books by schoolchildren are hard to trace because none have

[24] James Todd, *The Schoolboy and Young Gentleman's Assistant, Being a Plan of Education* (Edinburgh: 1748), 70. I note that, though the word 'gentlemen' is used in the title, the facts and skills communicated in the book were clearly aimed at middle-class children as well.

[25] Mairi Robinson (Ed.), *The Concise Scots Dictionary* (Aberdeen: Aberdeen University Press, 1985), 592.

[26] *Scroll Council Minutes*, Bound MSS, circa 1682-1875, ECA. *Final Council Minutes*, Bound MSS, circa 1682-1875, ECA. The minutes are uncatalogued and must be recalled from an offsite depository.

survived.[27] Based on the scroll books of University students, we can infer safely that those kept by schoolchildren were written on different kinds of loose and bound paper. Making the copied version of the notebook gave young notekeepers the opportunity to learn how to select and manipulate the kinds of paper required to organise information in different kinds of notebooks. There were, for example, choices to be made regarding the different sizes and brands of paper that might be used. Some students selected quarto sheets with the intent of leaving little white space around their inscriptions and drawings. Others used folio sheets so that they could space out the content. These choices were influenced by a student's finances and remind us that economic restrictions often played a role in the kinds of materials that notekeepers could use to make a notebook.

There were two fundamental skills required to make a *tabula folia*, that is to say, to mould a sheet of paper into a notebook page. First there was quiring, the ability to shape a sheet of paper into a quadriform format conducive to being a page. Second, there was what might be called 'codexing', the ability to gather and fix quires into a book format. I will treat these in turn.

Many student notebooks were made out of folded, unbound booklets called quires (today historians sometimes call them 'gatherings'). Constructing a manuscript book via the act of quiring was an established technique reaching back to

[27] One could possibly argue that Peter Purdie's 1823 school notebook is a scroll book. Its provenance, however, is unknown and this makes it difficult to say what stage of the notekeeping process it represents. [Anonymous], *Mathematics* (1823), Peter Purdie (Notekeeper), Bound MS, NLS MS 14288.

the codices of the middle ages. As noted by codicologists and ethnologists alike, transforming paper (or vellum) into efficiently designed quires required time and skill.[28] In the case of Scotland's school notebooks, the quiring process began with a student folding a loose-leaf quarto or octavo sheet in half. The product of this kind of folding (bifoliating) was a bifolium (plural bifolia).

A collection of bifolia stacked on top of each other, or laid inside each other, was a quire. Today it would be called an unbound booklet. It was this kind of interchangeable loose-leaf quire that students used to construct a good number of school notebooks, bound and unbound, during the Scottish Enlightenment. Notably, the experience of folding paper in this manner was slightly different from the kinds of folding used to make the printed pages of a book. [Figure 1] As explained in early modern printing handbooks, compositors intentionally arranged pages out of order on a sheet. Once printed, the pages on the sheet were folded in a manner that placed them in proper numeric order.[29] When compared to quiring, this technique made it harder to replace individual printed pages when mistakes were made.

The number of bifolia in a quire depended on the skills and resources of the student. Based on the quires of notes made at Edinburgh High School, it seems the student-made quires were small, ranging from eight to sixteen pages (which were

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[28] Steven W. May and Heather Wolfe, 'Manuscripts in Tudor England' in Ken Cartwright (Ed.), *A Companion to Tudor Literature* (Chichester: Wiley, 2010), 125–39. Livingston (2008), 89-107.

[29] Philip Luckombe, *The History of the Art of Printing* (London: Adlard and Browne, 1771), 410-438.

also called forms).[30] The ability to make paper folds and forms into a quire was an essential technique that had to be learned at some stage by most people who made an early modern notebook.[31] This being the case, historians usually overlook the fact that early modern student notekeepers were regularly practising quiring techniques. Learning to quire constituted a mode of internalizing a jointly linear and flexible conceptualization of ordered ideas even before they were represented as inscribed facts on paper. In addition to reinforcing the utility of gestalt principles such as symmetry, perpendicularity, rectilinearity, angularity, and parallelity via the iterative routines required to fold a piece of paper, the loose-leaf nature of prebound quires allowed children to remove sheets when they made mistakes.[32]

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[30] Several helpful specimens of prebound quires made by students can be found in the Edinburgh High School collection housed in Edinburgh City Archives. See, for example, Archibald Cullen's exercises, *Translation of English into Latin* (c. 1800), Loose leaf, ECA SL137/9/8. It consists of several quarto sheets folded into an octavo quire.

[31] Folding was used to make interactive paper devices in the early Royal Society as well. See Matthew C. Hunter, *Wicked Intelligence: Visual Art and the Science of Experiment in Restoration London* (Chicago: University of Chicago Press, 2013), 73-78.

[32] For the gestalt principles of visual culture, see: Rudolf Arnheim, *Art and Visual Perception: A Psychology of the Creative Eye* (Berkeley: University of California Press, 2004); Barbara Tversky, 'Visualising Thought', *Topics in Cognitive Science*, **3** (2011), 499-535.

Some children gathered together their loose-leaf, quired notes or assignments and sewed them together as well. This was the case during the 1780s for the Edinburgh High School student and future orientalist William Erskine, who sewed together a number of his Latin translations into a small notebook in an effort to keep them together.[33] [Figure 2] Sometimes students, the future novelist Sir Walter Scott and the future politician Lord Henry Bougham for instance, simply kept their loose-leaf bifolia exercises unbound, leaving behind helpful evidence of how students designed the kinds of quires that potentially could be made into a notebook.[34] When considered alongside the other paper moulding techniques mentioned above, it can be seen that the techniques required to manipulate a sheet of paper were just as important as those required to write on it. Some educators recognised the importance of such techniques and integrated them into their pedagogical systems.

The Scottish philosopher, educator and novelist Elizabeth Hamilton, for example, held that the material facets of books and notebooks were themselves learning tools. In her *Letters on the Elementary Principles of Education*, she observed that:

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[33] William Erskine, *Latin Exercise Book* (1784), Bound MS, ECA SL137/9/38.

[34] Walter Scott, *Translations of Latin into English and English into Latin* (c. 1800), Loose leaf sheet, ECA SL137/9/29. Henry Brougham, *Translation of English Phrases into Latin* (8 October 1790), Loose leaf sheet, ECA, SL137/9/3. See also the translations of Archibald Cullen that consist of two quarto sheets folded into an octavo booklet of four pages. Cullen, *Translation of English into Latin* (c. 1800).

> *The leather binding of books, the paper which forms the leaves, the thread on which these leaves are strung, and the characters that are printed on them, may be made instrumental in invigorating the conceptions: and I am persuaded, that habits of attention thus acquired, would be found of greater use in developing the faculties, than any lessons which the poor ignorant children could be made to read, or get by heart.*[35]

At the time, 'conception' and the notion of a mental 'faculty' were central components of associationism, an early form of cognitive science.[36] Like many leading Scottish educational commentators, Hamilton used associationism to frame her entire pedagogical system. In her view, the material management of paper was itself a cognitive technique, that is, an activity that shaped the memory and created rational capacities.

In addition to making quires, some schoolchildren purchased blank 'paperbooks'. They consisted of sheets folded in half and sewn together in the crease. Though they are seldom studied as an interactive medium that facilitated the management of predigital knowledge, paperbooks were sold by most early stationers or booksellers because adults frequently used them to manage domestic,

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[35] Elizabeth Hamilton, *Letters on the Elementary Principles of Education, Volume II, Fifth Edition* (London: Wilkie and Robinson, 1810), 251-252.

[36] The centrality of 'conception' is most clearly summarised in the Edinburgh lectures of Dugald Stewart, which were published as *Elements of the Philosophy of the Human Mind* (Edinburgh: Creech, 1792). See pages 132-150 for his discussion of conception.

commercial or artistic information rendered in pen, graphite or watercolours.[37] Paper books were sold in the same sizes as books, but student notekeepers tended to use quarto, octavo and duodecimo formats. The sewn binding prevented the pages from becoming disordered. Sometimes stationers (and even students) sewed on a piece of flexible cardboard as a cover.

Once students had inscribed their notes on quires or paperbooks, they then had to learn how to collate and fix a codex, that is, a manuscript book that, in the case of a notebook, was designed to act as a reference tool. The act of codexing required many skills, particularly since most school notebooks were assembled over months and sometimes years. The notebooks were bound in a variety of formats that ranged from simple stitches of string to elaborate leather bindings.[38]

[37] The uses and prices of Scottish paperbooks remain relatively understudied. A good indication of their price and popularity are the sales ledgers of the Edinburgh stationer Charles Elliot: see his *Ledger I* (1771-1777), Bound MS, NLS, John Murray Archive MS 43098. See also Stephen W. Brown, 'Paper Manufacture', in Stephen Brown and Warren McDougal (Eds.), *The Edinburgh History of the Book in Scotland, Volume 2* (Edinburgh: Edinburgh University Press, 2011), 61-64.

[38] Records of Scottish bookbinders from this period have not survived. William Zachs, 'Bindings', in Brown and McDougal (2011), 65-69. For England, see Jonathan E. Hill, 'From Provisional to Permanent: Books in Boards 1790-1830', *The Library*, 21 (1999): 247-273.

Sometimes blank pages were bound at the front or end for future use.[39] Close inspection of the watermarks, pagination and bindings of the paper inside school notebooks reveals that many of them are composites, that is, collocations of several sets of copied notes kept by children at different times in different courses.

Rather than recopying their notes all at once from start to finish in a bound, blank volume, many students assembled their bound compendia from a collection of paperbooks or quires.[40] The placement of the paper in school notebooks with cracked, split, uneven, ripped or loose bindings further indicates that the techniques of assembly were contingent upon the learning needs of the notekeeper. Likewise, though the order of the pages (and, hence, the subsequent content) was relatively set after it was made, students were presented with further opportunities to order what they had written when the time came to bind all their completed paperbooks into one leather-bound volume. Such compendia could be made immediately after a schoolchild's studies were completed, or they could be made at a later date.

As evinced in the four different sets of paperbooks bound in the *Schoolbook* of

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[39] The technique of inserting blank pages in early modern books and notebooks was commonly practised by adults. See Jonathan Gibson, 'Casting off blanks: hidden structures in early modern paper books', in James Daybell and Peter Hinds (Eds.), *Material Readings of Early Modern Culture* (Basingstoke: Palgrave Macmillan, 2010), 208–228.

[40] The term 'paper book' was used regularly during the eighteenth century to refer to blank, bound writing books. The term 'quire' was used to refer to foldings of unbound paper. See the entries for 'paper book' and 'quire' in the *OED*.

the student James Fowler during the 1780s, notes were not always bound in the order that they were written. Fowler lived in the Strathpeffer area of northwest Scotland and possibly attended school in Fodderty. As shown in Table 1, though a single volume today, Fowler's *Schoolbook* was originally four paperbooks that were kept over a period of four years.[41] [See Table 1] Once Fowler's paperbooks were bound together as a manuscript book, they ceased to be individual volumes and became sections. In many cases the erstwhile status of paperbooks was all but erased when binders trimmed their edges to form one, unified volume.[42]

The transformation of printed paperbooks into the sections of larger books during the early modern period was a crucial knowledge management technique used by adults to create and organise the large systems of printed and inscribed

[41] James Fowler, *Schoolbook of James Fowler* (1780), Bound MS, NLS MS 14284. For a set of bound notebooks that were also compendia assembled from a collection of smaller notebooks, see [Anonymous] *Perth Academy Notebooks, 3 Volumes*., 1787, I.M. (Notekeeper), Bound MSS, NLS MS 14294-6.

[42] School exercise notebooks were often assembled from collections of paperbooks as well. For comparison, see Alexander Kincaid's octavo *Latin Exercise Book* (1764), Bound MS, ECA, SL137/9/37, kept at Edinburgh High School. The cracked binding reveals that it first consisted of exercises recopied on individual paperbooks that were eventually bound together.

knowledge that were created to teach university students.[43] But the material structure of Fowler's notebook shows that schoolchildren were learning to practise this ordering technique as well, albeit on a smaller scale. Fowler chose to order his paperbooks topically, placing the mathematics sections first and the composition section last (see Table 1). But of course this technique of ordering paperbooks, which was essentially an extension of what Walter Ong once called topical logic, was a flexible process and could have been done differently had Fowler decided that the composition section was the most important.[44] Overall, shuffling paperbooks in a topical manner was an important manuscript management technique that allowed students to order their bound school notebooks in a manner that they found most useful.

Paying attention to the many skills associated with quiring and codexing notes foregrounds aspects of notekeeping that directly affected the ways in which students were able to composite words and lines on the page. For instance, as we will see later in this essay, students sometimes drew figures in their notebooks. [Figure 3] The practice worked in close conversation with the paper techniques used to

[43] Matthew Daniel Eddy, 'Tools for Reordering: Commonplacing and the Space of Words in Linnaeus' *Philosophia Botanica*', *Intellectual History Review*, **20** (2010), 227-252.

[44] Ong held that topical logic was a mode of classifying that grouped things according to convenient 'topics' (Greek: *topoi*; Latin: *loci*) and not necessarily according to natural kinds. Walter J. Ong, *Ramus, Method, and the Decay of Dialogue: From the Art of Discourse to the Art of Reason* (Chicago: University of Chicago Press, 2004).

assemble a student notebook. The best way to write or draw straight or curved lines, for example, was to inscribe them on a flat surface. This kind of surface did not exist in a thick, leather bound notebook because the binding forced the pages to curve outward in a way that made it difficult to render a straight line with a ruler or a curved line with a compass. Using the flat sheets of paper contained in a paperbook or quire in the pre-bound stage of the notebook eliminated this problem. Since quires were unbound, each page could be laid out flat. Though paperbooks were usually bound, they were thin, running between twenty and forty pages, and usually did not have boards. Because they were a single set of folded sheets, they naturally sat together and only required one or two stitches. All of these characteristics made it easy to press the paperbook open so that it lay flat, thereby making it possible to draw accurate figures.

The fact that notebooks were comprised of discrete, rearrangeable sheets of paper introduced an element of adaptability into the learning routines that influenced how children conceived and used a school notebook before and after it was bound. From the very start of the notekeeping process, even before students began to write, the paper itself was formatted as an orderly material. It was sold as a quadriform sheet, that is, a symmetric geometric shape. Students then created pages by folding sheets in half into a bifolia. Like the act of reading words, this act of folding paper imbued various kinds of meaning that made sense to the 'foldmaker'. The haptics of the technique facilitated an act of visual order that allowed students to begin to think about the material strictures and possibilities presented by a blank sheet of paper, transforming the page into a device, a *tabula folia*, intended for

organisational activities.[45]

The transitive affordances of paper led some during the eighteenth century to see a collection of sheets or bifolia as a 'machine'.[46] The loose-leaf nature of quires and the mobility of prebound paperbooks also meant that both could be moved and ordered in ways that fitted the needs of the notekeeper. The moveable nature of paper in the hands of schoolchildren created a situation in which the pages of a prebound school notebook rendered it an information management device, a paper machine. As shown in Markus Krajewski's work on the history of index cards, paper machines were part and parcel of the early modern world of predigital media. When individual paper storage devices were manipulated in concert over time, explains Krajewski, 'The force taking effect is the user's hand'. The movement of the sheets in this manner produces 'a mechanical work taking place under particular conditions'.[47] Like a pile of index cards, the preassembled quires or paperbooks of

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[45] For more on the meaningfulness of folding, see Jacques Derrida, *Paper Machine* (Stanford: Stanford University Press, 2003), 11-13.

[46] The 'machineness' of paper seems to have been recognised in a variety of contexts. Women in colonial America, for example, described the paper fan, a fashionable object at the time, as a 'little gay fluttering machine'. Susan M. Stabile, *Memory's Daughters: The Material Culture of Remembrance in Eighteenth-century America* (Ithaca: Cornell, 2004), 155-157.

[47] Markus Krajewski, *Paper Machines: About Cards and Catalogues, 1548-1929* (Cambridge, Mass.: MIT Press, 2011), 7. For the use of slips or sheets as information management devices, see also Staffan Müller-Wille and Isabelle Charmantier,

an Enlightenment school notebook functioned collectively as a paper machine because they allowed children to shuffle information into an ordered thinking device as they were creating it.

School notebooks continued to function as paper machines even after they were bound. When students used their notebooks after they finished a course, or when they finished school, they did not necessarily have to move through the pages one after another from start to finish. As the makers of their own notebooks, they were already familiar with the order of the subjects. They could dip about and jump from one part or page to the next as necessary, creating their own order within the postbound pages whenever they used it. From this perspective, the fixed order of the pages did not always matter and the contents could be used in whichever order the notekeeper saw fit to create. Thus, even after they were bound, school notebooks functioned as organised, but adaptable, collections of knowledge. Like manuscript commonplace books, they were, in the words of Anthony Grafton, 'information-retrieval machines'.[48]

There was a final characteristic inherent to the media of paper that allowed students to use school notebooks in a self-directed, interactive manner. As we will

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'Natural History and Information Overload: The Case of Linnaeus', *Studies in History and Philosophy of Biological and Biomedical Sciences* **43** (2012), 4-15.

[48] Grafton (2012). The comparison of commonplace notebooks to 'information-retrieval machines' occurs across pages 5-6. Similar mechanical metaphors occur on pages 8, 'information-recovery machine' and 23, 'information-management machines', as well.

see in the following sections, students designing mathematics, navigation, gauging and levelling notebooks often included technical figures as illustrations. Within this tradition, students rejected the widespread textbook practice of collating figures on one plate because it forced them to constantly turn between the figure and the narrative that explained its use and meaning elsewhere in the book.

Student notekeepers frequently drew figures on the page beside or below the narrative that explained how to use or interpret them. Children who made poetic notebooks also employed this user-friendly technique by including vignettes of the scenes they were describing.[49] This proprioceptive technique was yet another important form of knowledge in motion that allowed students to transform a sheet of paper into a *tabula folia*, a page moulded in a manner that was easy to use as an accessible storage device. Situating the figures in such a way enabled them to learn how to see that the relationship between representing and understanding was interactive and oftentimes intimately linked to where paper tools were placed within a notebook.

WRITING TECHNIQUES

Enlightenment historians have traditionally treated writing as a fixed object on paper. But what about the performative aspect – the 'writtenness' – of writing? More specifically, what were the techniques of writing, the modes through which

[49] John Black, *Juvenile Poetic works of John Black, Volume 2* (1797-8), Bound MS, NLS, MS.14233.

the pen was put to paper? How can they be used to understand the ways in which students were taught to conceptualise writing as they transformed the *tabula folia* into a *tabula verba*, a written page in a student notebook? For literate Scottish children writing was an activity that occupied much of their daily life. In addition to functioning as a mode of recording information, it also functioned as a mode of learning in its own right. The cultural historian Michel de Certeau once underscored this jointly developmental and performative facet of writing when he observed: 'In front of his blank page, every child is already put in the position of the industrialist, the urban planner, or the Cartesian philosopher—the position of having to manage a space that is his own and distinct from all others and in which he can exercise his own will.'[50]

If, like de Certeau, we wish to historicise the acts of writing performed on a *tabula folia*, then we must pay closer attention to how they were being learned or even theorised at any given point in the past. The same could be said in reference to treating student notebooks as valuable objects of historical enquiry. Fortunately, as we saw with Elizabeth Hamilton's comments on the material importance of moulding paper, Scottish pedagogues explicitly discussed such performances. This was mainly because the act of writing occupied a special place in the cognitive models they used to understand the mind.

From the mid-century forward, many educators in Scotland and other parts of Britain interpreted the performativity of writing via an associationist educational

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[50] Michel de Certeau, *The Practice of Everyday Life* (Berkeley: University of California Press, 2011), 134.

psychology that drew strong links between visual and mental order.[51] Dugald Stewart, whose works were widely read during the late Scottish Enlightenment, articulated this longstanding view in the 1790s moral philosophy lectures that he gave at the University of Edinburgh. Like many educators of the time, he conceptualised the page of a notebook as a picture that both visualised and influenced how ideas were organised in the mind.

As Stewart's comments on commonplace notekeeping indicate, ordering a notebook through writing was hardly an inconsequential act. In his words, 'A COMMON-PLACE [note]book, conducted without any method is an exact picture of the memory of a man whose inquiries are not directed by philosophy. And the advantages of order in treasuring up our ideas in the mind, are perfectly analogous to its effects when they are recorded in writing.'[52] Since everyone's mind was different, notekeepers had to judge for themselves which form of commonplace ordering worked best based on 'their own peculiar habits of association and

[51] Alan Richardson, *Literature, Education, and Romanticism: Reading as Social Practice, 1780-1832* (Cambridge: Cambridge University Press, 1994), 127-142. Andrew O'Malley, *The Making of the Modern Child: Children's Literature and Childhood in the Late Eighteenth Century* (London: Routledge, 2003), 86-101. Sarah Winter, *The Pleasures of Memory: Learning to Read with Charles Dickens* (New York: Fordham University Press, 2011), Chapter 1.

[52] Stewart (1792), 423.

arrangement.'[53]

The original audience for Stewart's lectures were the teenage boys who had learned to write and rewrite notebooks in Scotland's schools and academies. There they extended their scholarly recording techniques, the 'methods' in Stewart's terminology, that enabled them to create a useful school notebook. Perhaps the most important techniques were those which allowed them to structure the layout of the page into a format that helped them to observe what they were writing as they wrote, an act which transformed the page into a visual object, a verbal picture, that was easy to use.

There were two visual structures that Scotland's schoolchildren used to organise the space of their notebook pages: the module and the matrix. [Figure 4] At the most basic visual level, a module consisted of a heading, usually centred, followed by a block of narrative formatted as a sentence or paragraph. It could be used to structure one page, or it could also be designed to run across two facing pages.[54] It emerged as an important information management structure in

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[53] Stewart (1792), 441. The order of the written page captured the attention of many Enlightenment educators, including Immanuel Kant, the philosopher and professor at the University of Königsberg. See his 1768 essay 'On the first ground of the distinction of regions in space', James van Cleve and Robert E. Frederick (Eds.), *The Philosophy of Right and Left: Incongruent Counterparts in the Nature of Space* (Dordtrecth: Kluwer, 1991), 27-33, especially page 29.

[54] James Fowler of Strathpeffer, for instance, turned both the verso and recto pages into one unified module. Fowler Bound MS (1780), ff. 69v-70r.

European medieval codices after scribes began inserting blank spaces between words.[55] Early modern Scottish schoolchildren used the module to structure the pages of their notebooks. Less often they used a matrix, which divided the page into two columns so that it became a simple word or number table.

Since the *mise-en-page* techniques required to make a module or matrix were not necessarily subject specific, they were transferable and could be employed across the pages of all the notebooks kept by a student. Put more plainly, they formed the visual basis of notebooks kept for subjects that today would be classified as the arts, humanities and sciences. When considered in tandem with the orderly layouts evinced in school notebooks, Stewart's comments entailed the assumption that the writing techniques used to structure blank notebook pages were just as important as the factual content that they preserved.

Once written, modules and matrices became graphic containers, visual sorting tools, in which students efficiently processed and stored information. As shown in the work of the social anthropologist Jack Goody, tables of this nature played a central role in the development of Western culture, especially those that were structured as 'a matrix of vertical columns and horizontal rows'.[56] In addition to structuring the page as two columns, students were at times asked to write multi-columned matrices in practical mathematics courses; but the 1710 notebook of the

[55] Paul Saenger, *Space between Words: The Origins of Silent Reading* (Stanford: Stanford University Press, 1997).

[56] Jack Goody, *The Domestication of the Savage Mind* (Cambridge: Cambridge University Press, 1977), 53.

schoolboy James Dunbar also reveals that they were used for literary topics as well.[57]

Ever since medieval times modules and matrices had served jointly as information management tools and as a mode of interface between users and the texts.[58] In other words, they were stable *mise-en-page* technologies that had been successfully user-tested over the past one thousand years. Yet, though the module and matrix were longstanding technologies, they had to be learned, adapted, and valued anew by every student notekeeper in accordance to the institutions in which they put pen to paper on a daily basis. Notably, the ability to make and use script as a matrix or module created the capacity to order and sort knowledge in an efficient way that could be applied to any school subject, and to numerous mercantile, academic and personal uses when the student became older.

Young notekeepers were of course exposed to modules and matrices via their regular appearance in textbooks, the pages of which were usually laid out in a modular format.[59] Matrices also appeared regularly in textbooks. Compendia

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[57] James Dunbar, *A Volume Completed by James Dunbar in 1710 containing Arithmetic, Introduction to Algebra, and A More Compendious Way of Writeing than Ordinar Called the Short Hand, Making Use of Farthing's Alphabet* (1710), Bound MS, NLS Acc 5706/11.

[58] Hannah B. Higgins, *The Grid Book* (Cambridge, Mass.: MIT Press, 2009).

[59] Scotland's textbooks are reviewed in Law (1960), Wilson (1935) and Ian Michael, *The Teaching of English: From the Sixteenth Century to 1870* (Cambridge: Cambridge University Press, 1987).

featured tables of comparative weights, measures and prices.[60] Practical mathematics primers gave tables of 'powers' (squared, cubed and biquadrated) and logarithms used by surveyors, levellers, gaugers and navigators.[61] Grammars featured vocabulary, conjugation and declension tables, and geography primers presented tables of countries and cities.[62] The rows and columns of these tables required vertical and horizontal reading skills, a mode of interface that Lorraine

[60] See the weights and measures conversion tables in the many Edinburgh editions of George Fisher's *The Instructor: Or, Young Man's Best Companion*. For a representative example see the tables from pages 70 to 80 in Fisher (Edinburgh: Ruthven 1799). David Ramsey, *The Weaver and Housewife's Pocket-Book* (Edinburgh: Ramsay, 1750).

[61] George Fisher, *The Instructor; or Young Man's Best Companion* (Edinburgh: Alston, 1763), 323-327, and throughout E. Hoppus, *Practical Measuring Made Easy to the Meanest Capacity, Fifteenth Edition* (Edinburgh: Hunter, 1799), Alexander Ewing, *A Synopsis of Practical Mathematics* (Edinburgh: Smellie, 1771), and William Panton, *The Tyro's Guide to Arithmetic and Mensuration* (Edinburgh: Reid, 1771).

[62] Grammatical declension schemes occur throughout Alexander Adam, *Rudiments of Latin and English Grammar* (Edinburgh: Creech, Elliot and Balfour, 1786) and Thomas Ruddiman, *Rudiments of the Latin Tongue* (Edinburgh: Ruddiman, 1779). Good examples of geographic tables occur in Fisher (1763), 265-296, and throughout John Mair, *A Brief Survey of the Terraqueous Globe* (Edinburgh: Creech, 1775). All these texts were popular and went through multiple editions.

Daston has called 'right-angle reading'.[63] Such skills had to be learned and did not come easily to some children. Likewise, though it might have been easy for some to read modules and matrices in printed books, designing one in a notebook was much more difficult and required a host of different scribal skills. This was especially the case for younger students who were learning penmanship and bookkeeping, or for students whose previous education had not provided them with the time or materials required to perfect the art of making a module or matrix.

Students sometimes combined modules and matrices into visual forms that suited their own needs. As evinced in Figure 5, James Fowler, who we encountered in the previous section, fused two open-faced notebook pages (verso and recto) into a singular module that fell under one heading. He then used each page as a column, which effectively created a matrix. Throughout the notebook both pages contain script, however, I have chosen this specimen because the empty page makes it easier to see the graphite grid that he first drew to create a unified structure across two facing pages. Once the grid was in place, he then used his impressive chirographic skills to make the heading, subheadings and the prose.[64] Though Fowler achieved a sophisticated layout, many student notekeepers drew graphite grids before they put pen to paper.

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[63] Lorraine Daston, 'Super-Vision: Weather Watching and Table Reading in the Early Modern Royal Society and Academie Royale des Sciences', *Huntington Library Quarterly,* **78** (2015), 187- 215, page 205.

[64] Fowler Bound MS (1780), ff52v-53r.

Structuring the space of the written page as a verbal picture, a *tabula verba*, was a capacity-building exercise. It served as a form of visual training that strengthened the proprioceptive relationship between mind and hand. It reinforced the utility of information being arranged via the graphic principles of symmetry, perpendicularity, rectilinearity, angularity and parallelity. It enabled students to learn how to adapt tabular formats to fit their needs and to adjust and spatially reposition headings, keywords, paragraphs, rows and columns in a manner that instilled the ability to create a combinatorial word scheme on their own.[65] Within these forms clusters of words like headings and paragraphs functioned jointly as carriers of units of information *and* as cues that helped visually order the pages of notebooks. Correspondingly, the abilities required to design such modules and matrices constituted a set of alignment techniques, transforming the student notekeeper into a scribal compositor. As revealed in Figure 5, such *mise-en-page* techniques included everything from structuring the margins and sentence lines with graphite grids to navigating the centring and indenting patterns used to plot headings.

The compositorial techniques that students used to inscribe every page of a notebook were nuanced, required training and would have presented challenges for

[65] For early modern word-based combinatorics, see Francis A. Yates, *The Art of Memory* (London: Routledge, 1966) and Wilhelm Schmidt-Biggemann, *Topica universalis: Eine Modellgeschichte humanistischer und barocker Wissenschaft* (Hamburg: Meiner, 1983). For an example of combinatorics during the eighteenth century, see Grafton (2012), 25.

those who experienced developmental reading or writing difficulties. Needless to say, the process often ended in frustration. A striking case of scribal irritation is evinced in a matrix of shorthand symbols drawn by the adolescent James Dunbar in his school notebook. He drew the lines of his columns so unevenly that many of them simply ran off the page, rendering the right side of his table useless. Dunbar became so annoyed with his unsuccessful effort that he wrote the following in the space of a malformed (and hence, unusable) column: 'I am angry that I left a blank here and wrote filthy Scribble Scribble on the side and that I did not contrive it better.'[66] Here we can see that 'right-angle writing' was an acquired technique.

Dunbar's case reveals that in order to write within a module or matrix schoolchildren had to learn how to materially interface with paper through the act of writing. Moving the tip of the pen across paper was not a straightforward task, especially when it came to inscribing neat, curved letters. Early modern paper was made from pulped linen, rendering it thicker than modern paper and prone to grabbing the tip of the pen as a child drew the curved lines of letters and figures. Add to this the fact that linen pulp was strained and dried into paper inside gridded sieves that created parallel microgrooves called chain lines. A blank piece of paper, therefore, was not blank or smooth.

The microgrooves effected how some students used the pen to interface with paper. Depending on how the paper of a notebook was cut by a stationer, the

[66] Dunbar, Bound MS (1710). For further treatment of the Dunbar notebook and its visual context, see Matthew Daniel Eddy, 'The Shape of Knowledge: Children and the Visual Culture of Literacy and Numeracy', *Science in Context*, **26** (2013), 215-245.

grooved lines ran across the entire surface of the page in either an up-and-down or right-and-left pattern. In some cases, the rectilinear structure of the grooves made it easier to draw a grid, or to attempt to write straight sentences freehand or to form the edges of margins. However, in other cases the grooves could present challenges to inexperienced notekeepers. Hitting them the wrong way, for example, could easily jolt a student's stroke, making the line of a letter or figure uneven or filled with small deviations. In many respects this aspect of the blank page as a *tabula rasa*, or even a *tabula folia*, reveals that there were noteworthy material affordances and strictures that governed how student notekeepers interfaced with the blankness of paper, especially when they endeavoured to make a *tabula verba*.

The evenness of the script in many notebooks shows that students were remarkably adept at making well-formed letters across the textured surfaces inside the space of columns, rows and paragraphs. Some students even accomplished this feat when writing on poorly bonded paper or on the rough paper covers that protected some paperbooks. The Edinburgh High School student William Erskine, who we have already encountered, managed to write his Latin translations in a good hand over the coarse surface of his cardboard notebook cover when he ran out of paper.[67] As evinced in the scraps of notes kept by the Scottish naturalist Robert Brown in Australia and in the letters written by wives of Scottish merchants and diplomats living in India, the capacity to write well when presented with poor materials was essential for those who needed to record or organise information

[67] Erskine Bound MS (1784). The notebook consists of several quires sewn together inside a paper cover.

outside the comfort of their study.[68]

One of the main tasks of a writing instructor was to teach students how to structure the space of a blank page into a layout, usually a module, into which words or numbers could be written. This process of graphic design required a number of writing instruments that were used through a variety of techniques. Unlike today's disposable pens and pencils, the quills and ink used by Enlightenment students required more attention, both in terms of making them and using them. It is likely that some students had to make their own quills by gathering suitable feathers (usually from geese, but also crows) and then 'dutching' them to make the nib hard.[69] Since the tips of homemade and store-bought quills came unsharpened, students had to learn to use penknives. If the nib was misshapen, the ink could disfigure the page through blotting or it could distort the lines of the letters, making

[68] D. T. Moore and M. A. Beasley, 'The botanical manuscripts of Robert Brown', *Archives of Natural History*, **24** (2010), 237-280. The letter writing skills of Scottish women abroad are addressed throughout Emma Rothschild, *The Inner Life of Empires: An Eighteenth-Century History* (Princeton: Princeton University Press, 2011) and Maya Jasanoff, *Edge of Empire: Lives, Culture, and Conquest in the East, 1750-1850* (New York: Vintage Books, 2006).

[69] A helpful summary of quill making, including the dutching process, is given in the 'pens' entry in Daniel Keyte Sandford, Thomas Thomson and Allan Cunningham, *The Popular Encyclopedia: Being a General Dictionary of Arts, Sciences, Literature, Biography, History, and Political Economy* (Glasgow: Blackie & Son, 1836), 732-735.

them thick and hard to read.[70]

There were other basic instruments such as graphite pencils for ruling sentence lines and margins, gum for rubbing out graphite, razors for scraping off words written in ink, and powder for drying (pouncing) the ink. After learning the skills of ruling, rubbing, scraping and pouncing, some students also learned to design modules through the use of 'lead pens' or 'tracers', that is, pens with hard metallic tips which impressed a ruled compositorial grid into the fabric of the paper.[71] [Figure 6] The resulting lines then served as the basis for plotting words and making tables. If mastering all these instruments was not enough, there were also pedagogical theories that engendered different approaches to writing posture and to holding the pen.[72] In short, transforming the blank page into a module or matrix of words, a *tabula verba*, required training and practice.

The instruments, materials and techniques necessitated by writing rendered it an activity in which child notekeepers became mindful choreographers of their

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[70] Many writing instructors demonstrated how to make a pen to their students. For a helpful written account, see the section entitled 'Directions How to Make a Pen' on page 46 of Andrew Lawrie, *The Merchant Maiden Hospital Magazine* (Edinburgh: Darling, 1779).

[71] Tracers are described and depicted in J. Barrow, *A Description of Pocket and Magazine Cases of Mathematical Drawing Instruments* (London: Watkins, 1792).

[72] For an overview of the physiological theories surrounding the use of childhood braces, see T. Sheldrake, *An Essay on the Various Causes and Effects of the Distorted Spine* (London: Dilly, 1783).

own scribal performance on paper. Put another way, it would have been very difficult to form letters, plot headings, draw sentence lines, demarcate margins, align columns, or cross-align rows without observing the movement of the hand across the page. Nor would it have been possible to sharpen quills, pounce the page, scratch out mistakes or even make (or select) ink without being an observer of one's own writing. It was for this reason that instructors encouraged children to treat the act of writing as a form of rational observation.

The teaching handbook used by Edinburgh's Merchant Maiden Hospital for girls, for example, gave the following advice to its writing instructors: 'Here you copy three or more letters, but be at great pains to cause them [to] keep the distance equal, and to *observe* the shape of the letters.' Likewise, when demonstrating how to make a pen from a quill, the school's teachers were to ensure that the girls knew how to '*Observe* the method of one who makes a pen well, and endeavour to imitate it.'[73] Penmanship textbooks made similar connections between the act of writing and the act of observing.[74]

Accordingly, the writing techniques that underpinned the construction of Scottish school notebooks were conceptualised as being part of a larger regime of observational learning that trained students to actively engage with the world

[73] Both quotations are taken from Lawrie (1779), 44-46. Emphasis added.

[74] The first page of Fisher's *Instructor,* one of the most popular teaching compendia in Scotland, makes direct connection between the act of observation and the modes through which a child can read the letters of the alphabet. Fisher (1763), 1. Observation and literacy are linked on pages 5 and 61 as well.

around them. Learning to observe one's own writing as a notekeeper energised the kinds of visual skills that served as the starting point for understanding how the page could be mindfully schematised to fit different kinds of information. In other words, school notekeeping influenced the way that children perceived the modes through which the written page could operate as a verbal picture in motion. Like many forms of learning, notekeeping was a realtime activity.

But using a completed notebook was a realtime activity as well and I would like to close this section by considering how a notebook's design effected its future use as an informatic device. More specifically, I want to examine the presence of the many scanpaths that criss-crossed the notebooks made by Scottish schoolchildren.

Scanpaths were lines of sight that ran from heading to heading across the paragraphs of a page. They are now part and parcel of digital interface, however, they are by no means a new phenomenon. Their value was identified by a number of teachers in Britain, including Richard Grey, who called them 'technical lines'.[75] Student notebooks were full of such lines, indicating that 'sightlining' was yet another skill that underpinned the writing techniques of Scotland's student notekeepers. In Fowler's 1780 *Schoolbook* [Figure 5], for example, a technical line

[75] Richard Grey, *Memoria Technica, or, A New Method of Artificial Memory* (London: Lowndes, 1799), 48. Grey explained how the technical line ran between typographic markers that he had developed for the word matrices in his book. The book was a popular text in Lowland Scotland. The classic modern paper on scanpaths is David Noto and Lawrence Stark, 'Scanpaths in Saccadic Eye Movements While Viewing and Recognizing Patterns', *Vision Research*, **11** (1971), 929-942.

runs straight down the left margin from the following headings: 'Part II^{d}' to 'DEF I.st' 1 to 'DEF II.^{d}'. This navigational facet of headings is present in many student notebooks, especially those that addressed technical topics.[76]

Scanpaths made it possible for students to skim their notebook pages for information by allowing the eye to jump from one heading to another. More specifically, the paths running between the headings made it possible for them (or any other future readers) to navigate from one heading to another without having to read through the entire text. Creating modules in this regular, serialised pattern took both time and skill, and required students to closely observe what they were designing. Writing headings in the foregoing manner was one of the main techniques that transformed a *tabula folia* into a *tabula verba*, that is to say, an efficient information management picture. It also created easily recognisable scanpaths.

In order to maintain a regular pattern of technical lines through an entire notebook, students had to enact and consistently implement a graphic nomenclature of sorts, a chirographic code that enabled them to structure the internal space of modules and matrices in a systematic manner. Every time they mapped out the framework of the pattern with graphite or lead pen impressions, and every time they attempted to write according to the codes they had selected, they were effectively transforming the pages of their notebooks into interactive

[76] [Anonymous] *Practical Mathematics* (1804), [Anonymous Notekeeper] Bound MS, NLS 14285, f. 21-22. It is likely that this notebook was made by a student attending the Perth Academy.

visual platforms as they wrote. This kind of writing, so crucial to designing a school notebook in Scotland, provided students with the opportunity to learn how to structure knowledge on the page in a manner that could be accessed via the use of technical lines as they wrote and when they used the page in future.

Overall, the writing techniques required to transform blank pages into the modules and matrices of a self-organised notebook were by no means simple. The techniques reveal the rich material and visual foundations of the *tabula rasa* metaphor and explain why pedagogical authors such as John Locke and Dugald Stewart viewed the written page as an interactive picture.

DRAWING TECHNIQUES

Today we would seldom call a picture a 'table'. But, as mentioned in the beginning of this essay, during the eighteenth century, visualisations were still included under the wider designation of a *tabula*, a page that featured inscribed or printed knowledge.[77] This means that some student notekeepers also had to learn how to transform the *tabula rasa* into a *tabula figura*. Drawing, sketching and tracing figures increasingly played an important role in the arts, humanities and sciences throughout Europe at this time.[78] But how did Enlightenment students learn to

[77] Ferguson (1987).

[78] Baxandall (1985). Tim Ingold, *Lines: A Brief History* (London: Routledge, 2007). Lorraine Daston and Peter Galison's *Objectivity* (New York: Zone, 2007). David Rosand, *Drawing Acts: Studies in Graphic Expression and Representation* (Cambridge:

understand the meaning and use of a *tabula figura* through drawing one in a notebook? Likewise, how can the 'drawnness' of figures, the material and visual techniques of their construction, help us conceptualise the ways in which student notebook drawings laid the foundation for self-directed forms of scribal performance?

Within Scotland many educators treated drawing techniques as modes of learning. Accordingly, students were repeatedly asked to draw (and, hence, observe) figures in ways that helped them learn concepts such as distance, magnitude and altitude. As pointed out by the Scottish pedagogue George Turnbull, in addition to rendering an object on the page, learning to 'draw lines and figures upon paper', no matter how simple, was a useful knowledge-making technique. In his view, the arts of drawing were collectively important when they operated 'as a means, and not as an end; when they lead us to something else, and not when they are rested in as the principle part of instruction.'[79] In many cases that 'something else' was a set of linear concepts relevant to recognising symmetry, parallelity,

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Cambridge University Press, 2002). For Svetlana Alpers and Michael Baxandall on the eighteenth-century relationship between drawings (including predrawings) and pictorial intelligence see their coauthored *Tiepolo and the Pictorial Intelligence* (New Haven: Yale University Press, 1996). See also: Kärin Nickelsen, *Draughtsmen, Botanists and Nature: The Construction of Eighteenth-Century Botanical Illustrations* (Dordrecht: Springer, 2006).

[79] George Turnbull, *Observations Upon Liberal Education, In All Its Branches: In Three Parts* (London: Millar 1742), 273.

similarity, perpendicularity, angularity, equality, and proportionality. [80]

Turnbull's observation reminds us that Scottish students learned that, like the act of moulding a page or the act of writing a script, the act of drawing a notebook page was a valuable realtime learning tool, a manual activity that helped learners internalise and spatially understand different kinds of knowledge. As pointed out by pedagogues across Europe such as John Locke in Britain and August Hermann Franke in Germany, it was widely accepted that simple figures facilitated a child's powers of observation and apprehension.[81] Educators held that, no matter what kind of knowledge was being represented, simplicity was a virtue.

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[80] Linear concepts such as proportionality, similarity, perpendicularity, parallelity, etc., are mentioned repeatedly in most geometric textbooks. See: George Douglas, *The Elements of Euclid* (Edinburgh: Elliot, 1776). Robert Simson, *The Elements of Euclid* (Edinburgh: 1781), William Scott, *Elements of Geometry* (Edinburgh: Elliot, 1782). Nicolas Vilant, *The Elements of Mathematical Analysis… and A Synopsis of Book V of Euclid* (Edinburgh: Bell, 1798). Alexander Ingram, *The Elements of Euclid* (Edinburgh: Pillans, 1799). For an informative look at how the concept of proportionality functioned as a tool in the building of geometric systems, see John West, *Elements of Mathematics: Comprehending Geometry, Mensuration, Conic sections and Spherics* (Edinburgh: Creech, 1784), vi-vii.

[81] John Locke, *Some Thoughts Concerning Education* (London: Churchill, 1693), 184. Franke's use of pictures is discussed in Kelly Joan Whitmer, *The Halle Orphanage as a Scientific Community: Observation, Eclecticism, and Pietism in the Early Enlightenment* (Chicago: University of Chicago Press, 2015), 56.

The Scottish pedagogue Lord Kames summarised this widely held sentiment with the following advice: 'Begin not to teach Euclid, till he [a student] is well acquainted with the different figures. In that view, employ him to inscribe a circle in a square, a triangle in a circle, and so on. This manual operation will be an enticing amusement: and at the same time contribute to make the demonstrations more readily apprehended'.[82] Kames was communicating a view that educators should place a high value on drawing techniques as developmental learning tools. Notably, Kames, like many Scottish pedagogues, was following the lead of Locke's theory of mind that placed a high value on geometricized shapes, diagrams, that could be achieved by transforming a blank page into a *tabula figura*. In Locke's words: '*Diagrams* drawn on paper, are copies of *ideas*, and not liable to the uncertainty that words carry in their signification.'[83]

Within the wider world of children's publishing in Europe, authors steadily included more figures such as games, prints, and illustrated chapbook stories as the century progressed.[84] Yet, the picturesque beauty and charm featured in these relatively expensive images does not seem to have played a significant role in the

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[82] Home (1781), 235.

[83] John Locke, *An Abridgement of Mr. Locke's Essay Concerning Human Understanding* (Edinburgh: Donaldson, 1767), 164.

[84] Anke Te Heesen, *The World in a Box: The Story of an Eighteenth-Century Picture Encyclopaedia* (Chicago: University of Chicago Press, 2002). Barbara Maria Stafford, *Artful Science: Enlightenment Entertainment and the Eclipse of Visual Education* (Cambridge: MIT Press, 1996).

figural forms of representation used to educate most Scottish schoolchildren, particularly those of the working and middle class who attended parish or burgh schools. In fact, they rarely appear in school notebooks or in printed textbooks. The predominant visual forms presented in notebooks were word modules and matrices, and all the visual cues that they entailed.

Nevertheless, from the mid-century onward a rising number of Scottish students learned to draw a notable assortment of schematically-orientated figures in school subjects relevant to mensuration, geography, geometry and, in a handful of schools, natural philosophy. Consequently, when we speak of school notebook 'figures', we are speaking about a specific kind of schematic representation designed to help young learners understand how they might reduce the world to lines of measurement that, on the whole, could be used in trade, industry, land management or other kinds of professional or military contexts.

Constructing a figure required a variety of materials and instruments. These in turn were transformed through a plethora of drawing techniques such as tracing, sketching with graphite, shading through crosshatching and smudging, stippling, pricking, grooving with trace pens, and painting with watercolours. The smoothness and regularity of the lines in notebook figures, for instance, indicates that students were constantly observing their 'strokes' and 'scores' to fit the kinds of paper they used and the evenness of the lines they wanted to make in their figures. The precision and lack of deviations in the strokes in many notebooks reveals that student notekeepers learned to use various instruments of draughtsmanship, the most common being metal tipped drawing pens (sometimes with a protracting pin), graphite pencils, rulers for straight lines and compasses for circular lines. For more

advanced figures, there were protractors and sectors as well. Instrument makers sold these items individually or as part of a collection that was called a 'pocket case'.

School notebooks from Scottish academies, burgh schools and some grammar schools contain circles drawn first in graphite and then traced over in ink. This indicates that students were using compasses that had several interchangeable 'points' for drawing or impressing different kinds of lines. More specifically, they were using compasses equipped with a 'plain point' for impressions, a 'pencil point' for graphite lines, an 'ink point' for solid ink lines, and a 'dotting point' for dotted ink lines. These instruments were sometimes included in a pocket case. For more advanced students there was the 'magazine case', which, in addition to including a wider variety of the foregoing instruments, offered callipers and a watercolour set.[85] [See again Figure 6]

Using the implements contained in a pocket case or a magazine case, student notekeepers made two kinds of figures: shapes and tableaux, both of which were made in stages with a cluster of techniques. Both were drawn schematically, but some notebooks feature three-dimensional shading and colourisation (mainly through water-colouring) techniques.

Shapes usually came in the form of overtly geometricised, freestanding objects around which students left a field of open, white space. The most common shapes were polygons and polyhedrons, or metrological instruments such as dials,

[85] Barrow (1792), 6-7.

compasses, rulers, quadrants, etc.[86] As evinced in Figures 3 and 7, some renderings of instruments and polyhedrons were executed with great skill. The overarching impression given by most notebook figures was that of a stylised picture of clean contour lines to which students could easily attach information.

While figures of instruments, especially rulers and quadrants, were featured in contemporary textbooks,[87] it is important to note that, when viewed in reference to the process of student notekeeping, such shapes were not static entities. The act of drawing them, for instance, was a crucial element in how students learned to conceptualise them as objects. Creating a schematic form of representation endowed students with the capacity to observe in realtime how rectilinear and curvilinear depictions could serve as paper tools to which useful empirical or metrological information could be attached through inscription, thereby transforming the lines of the figures into different kinds of significant metrological space such as inches and degrees.[88]

In contrast to the standalone quality of freestanding shapes, tableaux were

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[86] Metrological instruments occur in many gauging and surveying notebooks. For representative specimens, see [Anon.], Bound MS (1804), f. 6 (quadrant), f. 33 (mariner's compass), f. 45 (geometrical square).

[87] See Fisher (1763) and John MacGregor, *A Complete Treatise on Practical Mathematics* (Edinburgh: 1792) for representative specimens of the kinds of instruments included on compendia plates.

[88] For the cognitive links between using instruments and creating metrological knowledge, see again Livingston (2008).

usually comprised of a collection of freeform shapes such as trees, houses, ships, islands, fields, mountains, countries and continents geometicised according to a grid or angles. A good example of a tableau can be seen in the levelling scene depicted in Figure 8. The collage of shapes in tableaux occurred most commonly as landscapes or maps; with the shapes being arranged in a manner that demonstrated the metrological relations between several objects, that is, in a manner directly relevant to levelling or gauging. Notably, as evinced in Figure 3, freestanding shapes were on occasion combined with a tableau in the notebooks of students who possessed more advanced drawing abilities.[89]

Knowing how to draw relationships like parallelity or even rectilinearity could be applied to a multiplicity of real or imagined objects when students became adults.[90] Once learned, the techniques helped students to conceptualise shapes as objects to which various kinds of meanings could be attached. The lines that delineated the space of a square, for example, were significant because they were proportionate, perpendicular and equal. Only once these qualities were understood could they be used to determine the area, volume, or movement of objects. Drawing techniques, therefore, implicitly imposed a set of perceptual categories that children could use to determine what was worth observing and then drawing in an

[89] My use of the term tableau is based on the following studies: John Bender and Michael Marrinan, *The Culture of Diagram* (Stanford: Stanford University Press, 2010), 19-52; Christine Poggi, *In Defiance of Painting: Cubism, Futurism and the Invention of Collage* (New Haven: Yale University Press, 1992), 86-89.

[90] Whitmer (2015), 54-59.

image. Crucially, though the utility of a polygon or polyhedron could be viewed in the many geometric diagrams included in textbooks, those in notebooks were more powerfully internalised through the manipulation of drawing instruments and paper during the act of rendering notebook figures.[91]

Yet, as intimated earlier, a *tabula figura* in a student's notebook might only contain a simple, freestanding shape. This was especially the case for notekeepers studying mathematics. At the time middle-class children in Scotland were increasingly learning how to draw portraits, landscapes and patterns for sewing. But, perhaps ironically, the acts of drawing practised by student notekeepers reversed the visualisation process promoted by avant-garde artists who believed that certain kinds of pre-drawings actually inhibited pictorial composition. Students attending the Edinburgh drawing academy of the influential landscape painter Alexander Nasmyth, for example, were introduced directly to painting techniques before they were even taught to draw.

Mary (née Fairfax) Somerville, who studied at Nasmyth's academy during the 1790s, sardonically summed up Nasmyth's method in her autobiography: 'I was not taught to draw, but looked on while Nasmyth painted.' [92] Unlike the dreamy

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[91] The use of compasses and rulers (straightedges) as tools which generate and sustain an objective world is examined in Livingston (2008), 109-120. See also Livingston's analysis of drawing the lines and curves of Euclidean geometry in *The Ethnomethodological Foundations of Mathematics* (London: Routledge, 1986).

[92] Mary Somerville, *Queen of Science: Personal Reflections of Mary Somerville*, Dorothy McMillan (Ed.), (Edinburgh: Canongate, 2001), 38.

landscapes of artists like Nasmyth, the tableaux featured in student notebooks were effectively collections of shapes that occurred in the form of countries or landmarks like mountains, houses or forests. [See again Figure 8] The shapes were usually arranged according to a quadrangular frame, a triangular grid, or as semi-three-dimensional vignettes.

If we step back for a moment and consider even the most basic skills that students learned to transform lines into shapes and tableaux, it becomes apparent that the *tabula rasa* concept was further enhanced by the abilities required to make, understand and use a *tabula figura*, that is to say, a notebook page that presented a figure. But many students were skilled drawers and it is worth further exploring the techniques they used and the visual capabilities that they bestowed.

Like the figures featured in the printed mathematics textbooks used in schools,[93] most notebook shapes were relatively simple in that they could be inscribed with instruments contained in a pocket case. Some students, most likely those who studied with drawing masters at home or at school, used pocket case instruments to execute advanced shading techniques that added dimensionality to geometric figures, a move that made it easier to see overlapping surfaces and volume. As evinced in figures like the expertly crosshatched, but partially translucent, pyramid drawn in the 1788 *Geometry* notebook of the schoolboy Robert

[93] See the figures throughout Fisher (1763), Hoppus (1799), Ewing (1771) and Panton (1771).

Jackson,[94] [Figure 7] students taking advanced mathematics courses learned through drawing complex shapes. Likewise, in addition to featuring standard instruments of measurement, some notebooks contain detailed iterations of air pumps, common pumps, thermometers, magic lanterns, compound microscopes and camera obscuras and prisms.[95]

Perhaps the most informative specimen of an instrument appears as the 'figure of an horizontal dial', a common sundial, in the dialling section of James Fowler's *Schoolbook*.[96] As evinced in Figure 9, Jackson did not finish it. Its incomplete state, however, makes it easier to see how he composed it and sheds much light on the drawing techniques that students employed to make a *tabula figura*. Dials were important during the Enlightenment because they were used alongside compasses and the gridded globes and maps that were employed in navigation. Accordingly, textbooks not only gave instructions on how to draw them,

[94] Robert Jackson, *Geometry Notebook of Robert Jackson, A Schoolboy* (1788), Bound MS, NLS MS 9156, f 23.

[95] For exemplary specimens used in the Perth Academy natural philosophy course, see [Anon.] *Perth Academy Notebook, Natural Philosophy Volume 3* (1787), (I. M. Notekeeper) Bound MS, NLS MS 14296, f. 56v (air pump), f. 57r (common pumps), f. 57v (thermometers), f. 77v (magic lantern), 78r (compound microscope), 90r (quadrant), 90v (camera obscura), f 91r (prism).

[96] Fowler, Bound MS (1780), f.134r. 'Dialling' was included in many compendia, including Fisher (1763), 313-319.

but also how to calibrate them to work in different latitudes.[97] Indeed, the latitude that Fowler penned on his dial (58 degrees north) reveals that he customised it to correspond to his own location in northwestern Scotland (Fodderty).

Fowler's dial makes it possible to see that students learned to understand technical instruments through sketching, tracing and shading them on a piece of paper that was destined to become a page in a notebook.[98] He began by pencilling a square in graphite with a ruler. Using a small compass, he then drew a graphite circle. Next, he drew radiating lines in graphite over the square and he used ink to inscribe stippling dots (over the circle), a signature, the date, a latitude bearing, the four points of the compass, and numeric labels for the radiating lines. Finally, he drew a hand for the dial in the brown chalk used by painters to make predrawings.

Had Fowler completed the dial, he most likely would have followed the common practice of colouring its different parts with paint.[99] Each step shows how the different drawing techniques were required to composite knowledge on the page – literally – in layers. This means that drawing the dial constituted a sophisticated form of graphic interface, both inside the image as well as between the

[97] Fisher (1763), 314-315.

[98] Fisher's dialling sections are accompanied by a fold out table of dials. Fisher (1763), 319-321.

[99] Fisher advised his readers to cut his dials out, paste them to wood and then to paint them. Further sections explain how to make paint from household items. See again Fisher (1763), 319-321.

image and the surrounding narrative that described the construction of the dial.[100] In short, he learned to understand the components of the dial as a paper tool by drawing and then labelling them.

The larger point to note here is that, like the techniques of moulding and writing, the techniques of drawing evinced in student notebooks provide a rich developmental picture of the material and visual basis of the *tabula rasa* metaphor. This point is also powerfully evinced in the maps that geography, gauging and surveying students drew in their notebooks. I would like to spend the rest of this section exploring the kinds of capabilities that such techniques imparted, and to contextualise why they are important for understanding how students used notekeeping to conceptualise linear forms of knowledge.

Fine examples of framed maps are exhibited in the *Maps* school notebook created by Jemima Arrow in 1815.[101] They were visualised with techniques that were most likely learned from a private tutor or from a teacher working at one of the private schools for girls that emerged in Scottish cities during the late eighteenth century. It contains Arrow's hand-drawn maps of France, the United Provinces, Germany, Italy and Turkey [Figure 10].[102] For each country Arrow inscribed two maps. The first map contained no labels or names. The notebook was initially drawn in graphite lines that were then traced over with ink. For the second map, she

[100] It is worth noting here that the dial occurs at the end of several pages of narrative on various kinds of dialling. Fowler Bound MS (1780), ff. 123r-133v.

[101] Jemima Arrow, *Maps* (1815), Bound MS, NLS MS14100.

[102] Arrow, Bound MS (1815).

turned the page and drew (or possibly traced) the same image, but she went further by water-colouring its borders, printing an alphabetical heading inside each country, and writing a legend (a matrix) on the opposite page that matched the headings with names of countries. She employed this two-step technique for all five countries in the notebook.

Aside from learning the geography of several Mediterranean countries, drawing and labelling maps with these kinds of techniques inculcated what Matthew Edney has called a sense of 'map-mindedness'.[103] In Arrow's case, the scientific spirit of the exercise afforded two very useful kinds of mnemonic devices. The first, a blank map, could be used to further test her memory without recourse to the legend. The second, a labelled map, could be used to test her memory against the legend of the facing page.

The notebooks of students who took surveying courses feature tableaux executed with more advanced drawing techniques, thereby taking the pictorial transformation of the *tabula rasa* into a *tabula figura* to a more complex level. Many of the notebooks contain maps depicting different kinds of terrain and property configurations reduced to geometric shapes through triangulation.[104] The

[103] Matthew H. Edney, 'British Military Education, Mapmaking, and Military "Map-Mindedness" in the Later Enlightenment', *The Cartographic Journal*, **31** (1994), 14-20. See also: Charles W. J. Withers, 'The Social Nature of Map Making in the Scottish Enlightenment c. 1682-c. 1832', *Imago Mundi*, **54** (2002), 46-66.

[104] A sample of notebooks that treat surveying and gauging include: [Anon.] Bound MS (1804); [Anon.], *Perth Academy Notebook* (c. 1790), (Anon. Notekeeper), Bound

neatness of such maps intimates that, like Arrow, surveying students probably learned drawing techniques by copying exemplars. Occasionally students made less stylized 'on site' maps as well, oftentimes with graphite lines peeking out from behind their overlaid ink strokes. These maps usually depict a local property and were most likely made as final assignments.[105]

Some property maps that occur in notebooks were bespoke for the student. These occur in notebooks overseen by private tutors who tailored the surveys to fit the needs of their tutees. For example, most of the questions, as well as most of the maps, contained in an anonymous student notebook kept from circa 1809 to 1812 were based on sites in the Yarrow area of southern Scotland.[106] In addition to learning how to reduce a landscape to mathematical observations, making survey maps of this nature enabled students to be ecological observers.[107]

A variety of gauging and levelling scenes also appear in school notebooks. Instead of being arranged according to a quadrangular frame or triangulation, these were structured according to a variety of angles that served to determine the

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MS, NLS, MS 14291; [Anonymous], *Surveying Journal and Accounting Ledger* (1809-1812), (Anon. Notekeeper), Bound MS, NLS MS 14283.

[105] Perth river examples occur in notebooks taken by Perth Academy students. For two examples, see 'A Plan of the North Inch of Perth', in [Anon.], Bound MS (1804), f. 121, and 'N. Inch of Perth', in [Anon.] Bound MS (c. 1790), f. 64v.

[106] [Anon.] Bound MS (1809-1812).

[107] Stephen H. Spurr, 'George Washington, Surveyor and Ecological Observer', *Ecology*, 32 (1951), 544-549.

distance between objects. The most detailed specimens occur in tableaux rendered by students attending Perth Academy during the last decades of the eighteenth century.[108] Figure 8 shows that some of them lavishly illustrated their notebooks with expertly designed landscapes to accompany various mensuration exercises used in gauging.[109]

Like the maps in Arrow's geography notebook, gauging, levelling and surveying tableaux appear alongside the narrative that describes them. The bespoke nature of this format is complemented by the fact that, while popular mensuration textbooks such as Alexander Ewing's *Practical Mathematics* or Alexander Ingram's *New Seaman's Guide* included plates that featured only a handful of similar vignettes, student notebooks include one for every problem, making it easier to see, and hence learn, how gauging, surveying or levelling could be applied to everyday situations [see again Figure 8].[110]

While the drawing techniques used to make tableaux were more nuanced than

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[108] [Anonymous] *Perth Academy Notebooks, 3 Vols.* (1787), Bound MS, NLS MS 14294-6. [Anonymous], *Perth Academy Notebook* (1780s-90s), Bound MS, NLS MS 14291.

[109] [Anonymous] Bound MS (1780s-90s).

[110] Compare, for example, the levelling figures in: Alexander Ewing, *A Synopsis of Practical Mathematics* (Edinburgh: Fairbairn, 1799), Plate III. Anonymous Bound MS (1804), f. 123. Ewing's *Synopsis* was a popular text in Scotland and had numerous reprintings in the 1790s alone. Alexander Ingram, *The New Seaman's Guide, and Coaster's Companion* (Edinburgh: Sehaw, 1800).

those required to make freestanding shapes, there were a number of shared techniques that students learned to employ across both forms of representation. As intimated in my observations about the narrative descriptions that accompanied shapes and tableaux, the techniques of drawing often interacted in realtime with the techniques of writing words. Put another way, the *tabula figura* oftentimes had to be combined with elements of the *tabula verba*. Aside from the occasional presence of a stylised map, the geometric and schematic nature of figures meant that they were rarely self-explanatory. It was for this reason that students seldom included them in school notebooks without a written text that explained what they were meant to represent. The text was often cued to the figure through the use of literary technologies such as alphanumeric headings, labels or prose written on or beside the figure.

Examples of this common practice occur in Figures 3 and 10, but the composition of Robert Jackson's pyramid in Figure 7 is particularly striking. Close examination of the strokes and the modes through which it was skilfully plotted adjacent to its verbal description further reveals that students were actively designing the space of the page by plotting words around figures. Based on the way in which the words flow evenly around the pyramid, it is clear that Jackson drew the image first and then added the narrative. This technique required him to pre-plan the layout of the page and it enabled him to create a seamless visual integration of the script and the figure.

Many of the combinations of script and figures in school notebooks were executed within a word module, which meant that students could skim the headings to find them once the notebook had been completed. Since notebook figures

needed to be positioned within or nearby textual material that explained what they meant, the success of the entire visualisation was dependent upon the compositorial techniques that students used to lay out their notebook pages as modules. Far from being a unique occurrence, the meanings of many Enlightenment figures, particularly those circulating in scientific or technological contexts, were dependent upon the descriptive texts that accompanied them.[111] By jointly writing words and drawing figures, student notekeepers were learning how to mitigate the visual limitations of figural representation.

When we consider all the drawing techniques evinced in student notebooks, it becomes clear that, like the modes of interface required to execute moulding and writing techniques, the modes through which students composited a figure enrich the *tabula rasa* metaphor by adding a hitherto unnoticed developmental layer, one in which the blank page functioned as a starting point for an interactive process of representation and learning.

CONCLUSION

In this essay we have considered the *tabula rasa* in light of the dynamic moulding, writing and drawing techniques required to transform blank sheets of paper into a

[111] The longstanding reciprocal relationship between printed figures and words, see Horst Bredekamp, Vera Duenkel and Birgit Schnieder (Eds.), *The Technical Image: A History of Styles in Scientific Imagery* (Chicago: University of Chicago Press, 2015). For manuscripts, see the captions of the figures in Daston and Galison (2007), 84-98.

student notebook, that is, a purposeful and user-friendly artefact. We traced these techniques in reference to the material and visual conditions required to make a page as a *tabula folia*, script as a *tabula verba* and an image as a *tabula figura*. The affordances inherent in these forms and the capabilities entailed in the many techniques required to make them reveal a developmental richness of the *tabula rasa* that far exceeds the notion of blankness that scholars have frequently attributed to it. Rather, the metaphor reflected a much wider meaning, one which drew from the considerable amount of time, effort, materials and concentration inherent in the techniques required to make a page, codex, module, matrix, shape or tableaux. This meaning rendered the *tabula rasa* and, hence, the mind, a longitudinal entity, something constructed in stages over time and dependent upon a wide set of preconditions made possible through students' abilities and the resources afforded by their institutional contexts.

Through expanding the *tabula rasa*, this essay has revealed that, in addition to using textbooks to establish what students were supposed to be learning, it is equally important to examine notebooks with a view to reconstructing a more faithful picture of what students were actually doing while they learned. Indeed, making notebooks helped students think more efficiently. The fact that the visual, material and conceptual skills afforded by the tools and techniques of notekeeping were being experienced at such an early age also reveals that the cognitive development of Enlightenment students was directly impacted by the forms of interface provided by the notebook in its capacity as a learning device. From a cultural perspective, the techniques of notekeeping underpinned essential modes of information management that made it possible to represent knowledge on paper

during the Enlightenment. This essay has shown that student notebooks played a core role in the conceptualisation and transmission of such skills.

Finally, the histories of the Scottish Enlightenment that have been written over the past century have repeatedly emphasised that the graduates of Scotland's schools and academies often went on to extraordinary careers, both inside Scotland and throughout the British Empire. We have encountered the student notebooks of several personalities who participated in this phenomenon, particularly the orientalist William Erskine, the politician Lord Henry Brougham and the novelist Sir Walter Scott, all of whom pursued publishing careers that were fundamentally dependent upon the techniques of notekeeping. But of course, as the variety of notebooks discussed in this essay so richly reveals, these authors only represent a fraction of the students who were educated by Scotland's schools, academies and tutors. It is arguably in the seemingly ordinary notebooks of students such as James Fowler, Jemima Arrow, Robert Jackson, James Dunbar and the scores of other anonymous student notekeepers that the real flavour and variety of Scotland's educational system emerges. In many respects their very existence speaks to the system's success in teaching a vibrant variety of students how to use a notebook as a powerful paper technology.